

CHAPTER 5

COMBAT TECHNIQUES OF FIRE

Technique of fire is the method of delivering and controlling effective fire. The machine gunners must be trained in the standard methods of applying fire. This chapter discusses combat techniques of fire, application of fire on the battlefield, and advanced gunnery. Before the machine gun can be employed to its full potential, the soldier must know and be trained on characteristics of fire, classes of fire, types of targets, and application of fire.

Section I. CHARACTERISTICS OF FIRE

Each gunner must know the effects of rounds when fired. Factors influencing the path and strike of rounds are not limited to applying the fundamentals. They include the velocity of the round, gravity, terrain, atmospheric conditions, and the innate differences between each round.

5-1. TRAJECTORY

The trajectory is the path of the round in flight (Figure 5-1). The gunner must know the machine gun trajectory to effectively fire the weapon throughout its full range. The path of the round is almost flat at ranges up to 300 meters; then it begins to curve, and the curve becomes greater as the range increases.

5-2. MAXIMUM ORDINATE

Maximum ordinate is the highest point the trajectory reaches between the muzzle of the weapon and the base of the target. It always occurs about two-thirds of the distance from the weapon to the target. The maximum ordinate increases as the range increases (Figure 5-1).

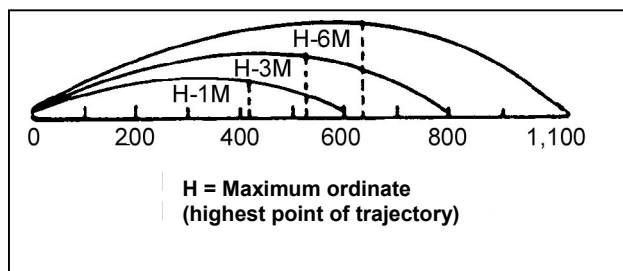


Figure 5-1. Trajectory and maximum ordinate.

5-3. CONE OF FIRE

When several rounds are fired in a burst from any machine gun, each round takes a slightly different trajectory. The pattern these rounds form on the way to the target is called a cone of fire (Figure 5-2, page 5-2). This pattern is caused primarily by vibration of the machine gun and variations in ammunition and atmospheric conditions.

5-4. BEATEN ZONE

The beaten zone (Figure 5-2) is the elliptical pattern formed by the rounds striking the ground or the target. The size and shape of the beaten zone changes when the range to the target changes or when the machine gun is fired on different types of terrain. On uniformly sloping or level terrain, the beaten zone is long and narrow. As the range to the target increases, the beaten zone becomes shorter and wider. When fire is delivered on terrain sloping down and away from the machine gun, the beaten zone becomes longer. When fire is delivered on rising terrain, the beaten zone becomes shorter. The terrain has little effect on the width of the beaten zone.

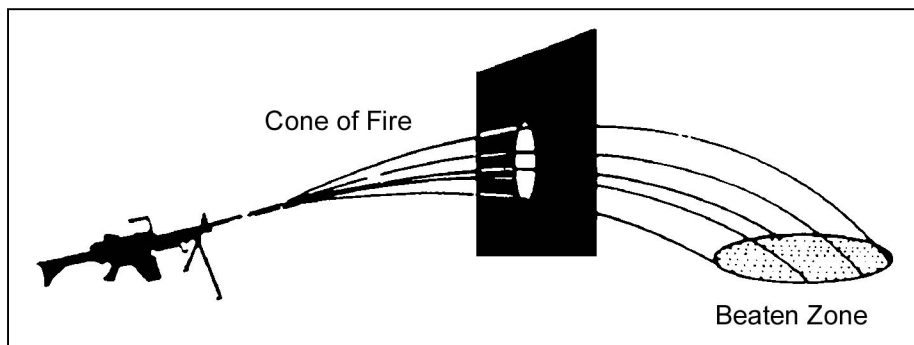


Figure 5-2. Cone of fire and beaten zone.

5-5. DANGER SPACE

The danger space is the space between the machine gun and the target where the trajectory does not rise above 1.8 meters (the average height of a standing soldier). This space includes the area of the beaten zone. When the machine gun is fired on level or uniformly sloping terrain at a target less than 700 meters away, the trajectory does not rise above the average height of a standing soldier. When targets are engaged on level or uniformly sloping terrain at ranges greater than 700 meters, the trajectory rises above the average height of a standing soldier, therefore, not all the distance between the machine gun and the target is danger space.

Section II. CLASSES OF FIRE

Machine gun fire is classified with respect to the ground, the target, and the weapon.

5-6. RESPECT TO THE GROUND

Fire with respect to the GROUND (Figure 5-3) includes grazing and plunging fires.

a. **Grazing Fire.** Grazing fire occurs when the center of the cone of fire does not rise more than 1 meter above the ground. When firing on level or uniformly sloping terrain, the gunner can obtain a maximum of 600 meters of grazing fire.

b. **Plunging Fire.** Plunging fire occurs when the danger space is confined to the beaten zone. Plunging fire also occurs when firing at long ranges, from high ground to low ground, into abruptly rising ground, or across uneven terrain, resulting in a loss of grazing fire at any point along the trajectory.

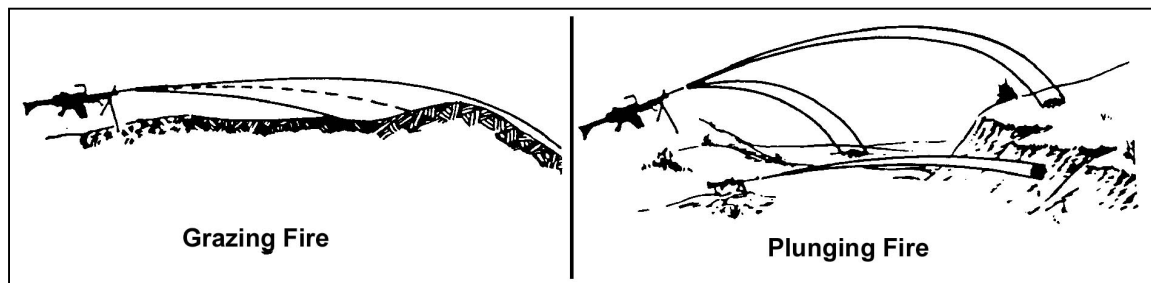


Figure 5-3. Classes of fire with respect to the ground.

5-7. RESPECT TO TARGET

Fire with respect to the TARGET includes frontal, flanking, oblique, and enfilade fires.

a. **Frontal Fire.** Frontal fire is when the long axis of the beaten zone is at a right angle to the front of the target. An example is when firing at the front of a target (Figure 5-4).

b. **Flanking Fire.** Flanking fire is firing at the side of a target (Figure 5-4).

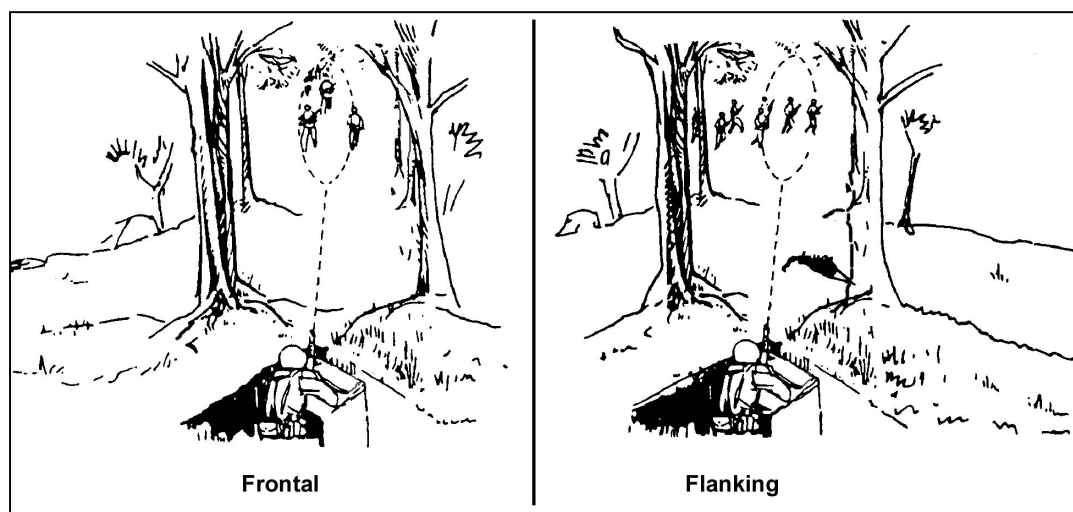


Figure 5-4. Frontal fire and flanking fire.

c. **Oblique Fire.** Oblique fire is when the long axis of the beaten zone is at an angle other than a right angle to the front of the target (Figure 5-5).

d. **Enfilade Fire.** Enfilade fire is when the long axis of the beaten zone coincides or nearly coincides with the long axis of the target. This type of fire is either frontal or flanking. It is the most desirable type of fire with respect to a target, because it makes maximum use of the beaten zone (Figure 5-5, page 5-4).

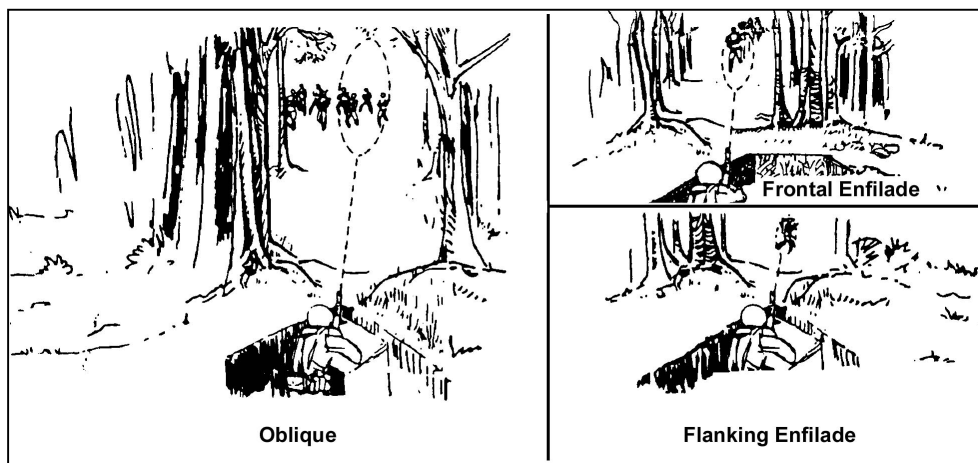


Figure 5-5. Oblique fire and enfilade fire.

5-8. RESPECT TO MACHINE GUN

Fire with respect to the machine gun (Figure 5-6) includes fixed, traversing, searching, and traversing and searching, and free-gun fires.

a. **Fixed Fire.** Fixed fire is fire delivered against a point target when the depth and width of the beaten zone covers the target. Fixed fire also means only one aiming point is necessary to provide coverage of the target.

b. **Traversing Fire.** Traversing fire is fire distributed in width by successive changes in direction. The gunner selects successive aiming points throughout the width of the target. These aiming points must be close enough to ensure adequate coverage but not so close as to waste ammunition.

c. **Searching Fire.** Searching fire is fire distributed in depth by successive changes in elevation. The gunner selects successive aiming points in depth. The changes made in each aiming point will depend on the range and slope of the ground.

d. **Traversing and Searching Fire.** Traversing and searching fire is fire distributed in width and depth by successive changes in direction and elevation. Combining traversing and searching provides good coverage of the target. Adjustments are made in the same manner as described for traversing and searching fire.

e. **Free-Gun Fire.** Free-gun fire is fire delivered against targets requiring rapid major changes in direction and elevation that cannot be applied with the T&E mechanism. To deliver this type of fire, the gunner removes the T&E mechanism from the traversing bar on the tripod, allowing the weapon to be moved freely in any direction.

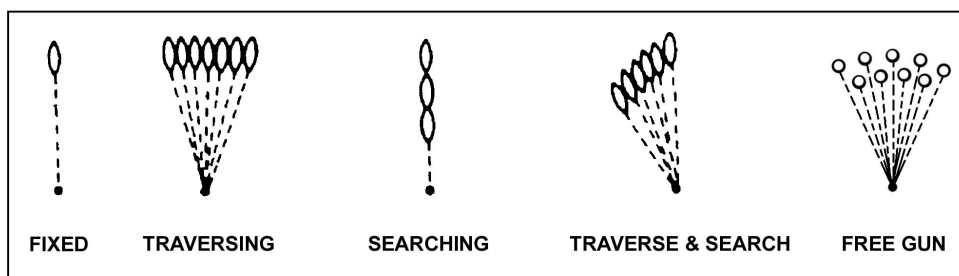


Figure 5-6. Classes of fire with respect to the machine gun.

Section III. APPLICATION OF FIRE

Application of fire consists of the methods the gunner uses to cover a target area. Training these methods of applying fire can be accomplished only after the soldiers have learned how to recognize the different types of targets they may find in combat, how to distribute and concentrate their fire, and how to maintain the proper rate of fire. Normally, the gunner is exposed to two types of targets in the squad or platoon sector: enemy soldiers and supporting automatic weapons. These targets have priority and should be engaged immediately.

5-9. TYPES OF TARGETS

Targets presented to the gunner in combat are usually enemy troops in various formations, which require distribution and concentration of fire. Targets with width and depth must be thoroughly covered by fire.

a. **Point Targets.** Point targets require the use of a single aiming point. Examples of point targets are enemy soldiers, bunkers, weapons emplacements, and lightly armored vehicles. Fixed fire is delivered at point targets.

b. **Area Targets.** Area targets may have considerable width and depth and may require extensive traversing and searching fire. These include targets in which the exact location of the enemy is unknown. The following are varieties of area targets likely to be engaged.

(1) *Linear Targets.* Linear targets have sufficient width to require successive aiming points (traversing fire). The beaten zone effectively covers the depth of the target area (Figure 5-7). Traversing fire is delivered at linear targets.

(2) *Deep Targets.* Deep targets require successive aiming points (searching fire) (Figure 5-8, page 5-6). Searching fire is delivered at deep targets.

(3) *Linear Targets with Depth.* Linear targets with depth have sufficient width requiring successive aiming points in which the beaten zone does not cover the depth of the target area. A combined change in direction and elevation (traversing and searching) is necessary to effectively cover the target with fire (Figure 5-9, page 5-6). Traversing and searching fire are delivered at linear targets with depth.



Figure 5-7. Linear target.



Figure 5-8. Deep target.



Figure 5-9. Linear targets with depth.

5-10. DISTRIBUTION, CONCENTRATION, AND RATE OF FIRE

The size and nature of the target determine how the gunner applies his fire. He must manipulate the machine gun to move the beaten zone throughout the target area. The rate of fire must be controlled to adequately cover the target but not waste ammunition or destroy the barrel.

- a. Distributed fire is delivered in width and depth such as at an enemy formation.
- b. Concentrated fire is delivered at a point target such as an automatic weapon or an enemy fighting position.
- c. The rates of fire that can be used with the machine gun are sustained, rapid, and cyclic. These rates enable leaders to control and sustain fire and prevent the destruction of barrels. More than anything else, the size of the target and ammunition supply dictate the selection of the rate of fire.

(1) *Sustained Fire.* Sustained fire for the M249 is 85 rounds per minute in bursts of 3 to 5 rounds. The M60 and M240B are 100 rounds per minute in bursts of 6 to 9 rounds. The gunner pauses 4 to 5 seconds between bursts. The barrel should be changed after firing at sustained rate for 10 minutes. This is the normal rate of fire for the gunner.

(2) *Rapid Fire.* Rapid fire for the M249, M60, and M240B gunner is 200 rounds per minute in bursts of (6 to 8 M249) 10 to 12 rounds. The gunner pauses 2 to 3 seconds

between bursts. The barrel should be changed after firing at a rapid rate for 2 minutes. This procedure provides for an exceptionally high volume of fire, but for only a short period.

(3) *Cyclic Fire*. Cyclic fire uses the most ammunition that can be used in 1 minute. The cyclic rate of fire with the machine gun is achieved when the trigger is held to the rear and ammunition is fed into the weapon uninterrupted for one minute. Normal cyclic rate of fire for the M249 is 850 rounds, M60 is 550 rounds, and for the M240B it is 650 to 950 rounds. Always change the barrel after firing at cyclic rate for 1 minute. This procedure provides the highest volume of fire that the machine gun can fire, but this adversely affects the machine gun, and should only be fired in combat under emergency purposes only.

5-11. TARGET ENGAGEMENT

The gunner engages targets throughout his sector. He must know how to effectively engage all types of targets either by himself or in conjunction with another gunner.

a. Single Gunner.

(1) *Point Target*. When engaging a point target, the gunner uses fixed fire (Figure 5-10). If the target moves after the initial burst, the gunner adjusts fire onto the target by following its movement.

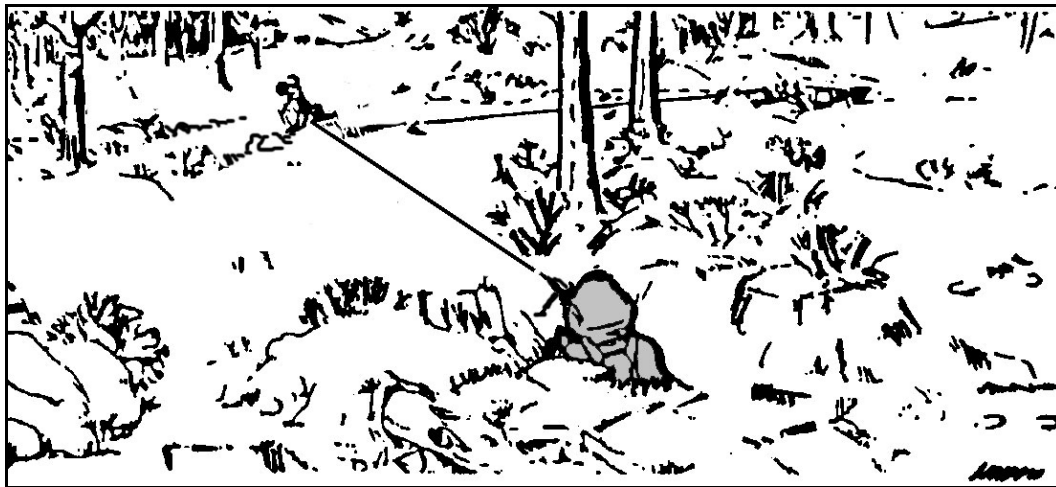


Figure 5-10. Engagement of point target.

(2) *Area Target*. When engaging an area target, the gunner fires in the center of mass, then traverses and searches to either flank (Figure 5-11, page 5-8). Upon reaching the flank, he reverses direction and traverses and searches in the opposite direction. A leader may indicate the width and depth of the target.

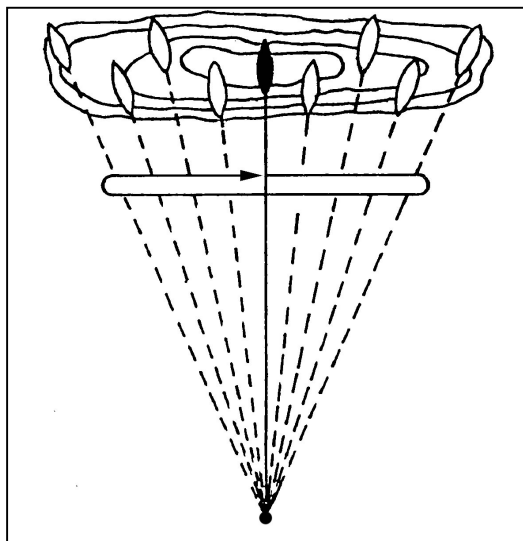


Figure 5-11. Engagement of area target.

(3) *Linear Target.* When engaging a linear target, the gunner traverses the machine gun to distribute fire evenly onto the target. He must cover the entire width of a linear target. The initial point of aim is on the midpoint. The gunner then manipulates to cover the rest of the target. If a linear target is hard to identify, a leader may designate the target by using a reference point (Figure 5-12). When this method is used, the leader determines the center of mass of the target and announces the number of meters from the reference point that will cause the gunner to aim on the center of mass. The reference point may be within or adjacent to the target (Figure 5-13). However, the reference point should be on line with the target for the best effect. After the command to fire has been given, the leader maintains and controls the fire by subsequent fire commands.



Figure 5-12. Engagement of hard-to-identify linear targets with a reference point outside the target area.

(4) *Deep Target.* When engaging a deep target, the gunner must use searching fire. If the range is announced, he initially aims on the midpoint of a deep target unless another portion of the target is more critical or presents a greater threat. The gunner then searches

down to one aiming point in front of the near end and back up to one aiming point beyond the far end. If a deep target is hard to identify, use the reference points to designate the center of mass. The extent (depth) of the target is always given in meters.

(5) *Linear Target With Depth.* When engaging a linear target with depth, the gunner uses traversing and searching fire. He begins engagement at the midpoint of the target unless another portion of the target is more critical or presents a greater threat. He traverses and searches to the near flank, then back to the far flank. When engaging hard-to-identify linear targets with depth, he designates the flanks and midpoint with rifle fire. The reference-point method is not used because at least two reference points are required to show the angle of the target.



Figure 5-13. Engagement of hard-to-identify targets with a reference point within the target area.

b. Pair of Gunners.

(1) *Area Targets.* When using a pair of machine guns to engage area targets, the gunner on the right fires on the right half, and the gunner on the left fires on the left half. The point of initial aim and adjustment for both gunners is on the midpoint. After adjusting fire on the center of mass, both gunners distribute fire by applying direction and elevation changes that give the most effective coverage of the target area. The right gunner traverses to the right, applies the necessary amount of search, and fires a burst. He traverses and searches up and down until the right flank of the area target has been reached. The left gunner traverses and searches to the left flank in the same way. Both gunners then reverse the direction of manipulation and return to the center of mass, firing a burst after each combined direction and elevation change (Figure 5-14, page 5-10).

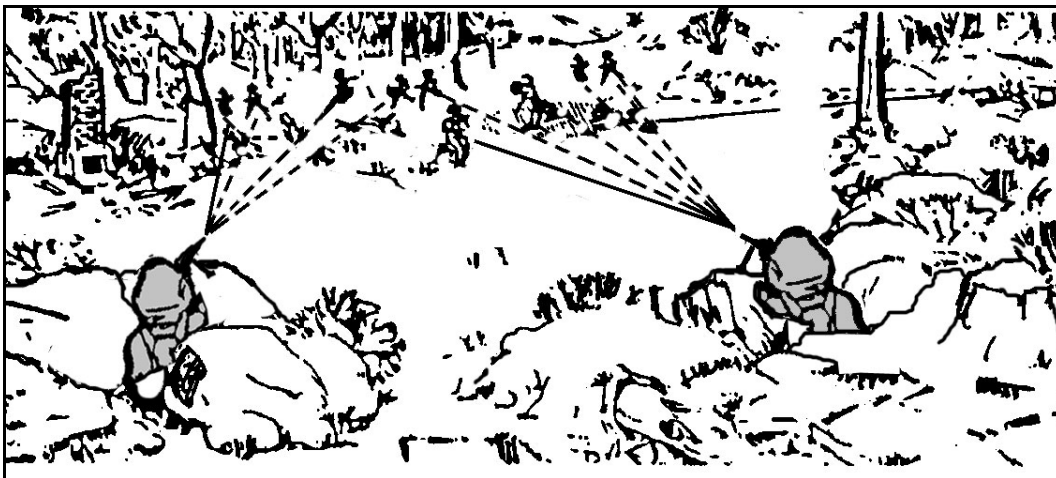


Figure 5-14. Engagement of area targets with a pair of gunners.

(2) *Linear Targets.* When using a pair of machine guns to engage a linear target, the target is divided at midpoint with the gunner on the right of the target firing on the right half, and the gunner on the left of the target firing on the left half (Figure 5-15).

(a) Both gunners aim on the midpoint initially. After adjusting on the midpoint, the gunner on the right traverses right, firing a burst after each change in direction until the rounds reach one aiming point beyond the right flank (this ensures complete target coverage). The gunner on the left traverses to the left flank in the same way the gunner on the right did. Both gunners then reverse their directions and return to the midpoint. The gunner must select aiming points for each burst rather than "spray" the target area.

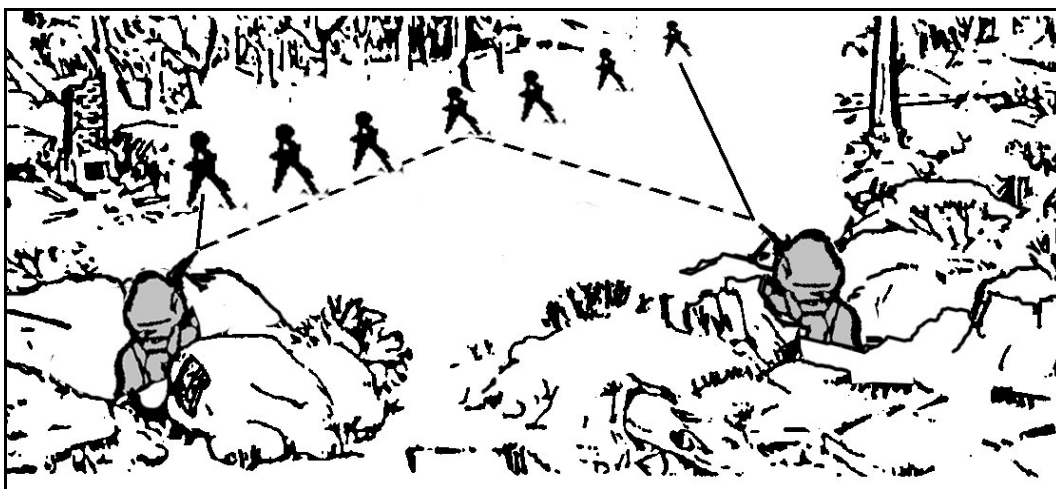


Figure 5-15. Engagement of linear targets with a pair of gunners.

(b) If one part of the target is a greater threat, fire can be concentrated on the greater threat by dividing the target unevenly. This special division of the target is done with fire commands. To preclude confusion, the gunners initially aim on the midpoint regardless of the special division to be made.

(3) *Deep Targets*. When using a pair of machine guns to engage a deep target, the initial point of aim is also on the midpoint for both gunners. Normally, the gunner on the right has the near half and the gunner on the left has the far half. Since enfilade fire is being used, they do not adjust on the midpoint of the target, because the long beaten zone compensates for any range errors. After the initial burst, the gunner on the right searches down to one aiming point in front of the near end of the target, and the gunner on the left searches up to one aiming point beyond the far end. Both gunners then reverse their direction of search and return to the midpoint (Figure 5-16).

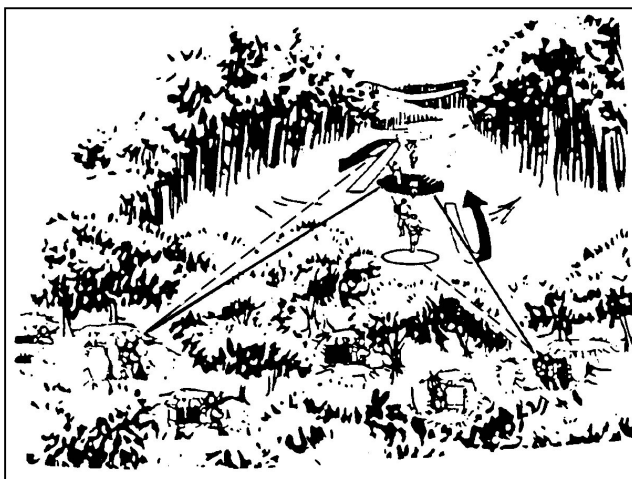


Figure 5-16. Engagement of deep targets with a pair of gunners.

(4) *Linear Target With Depth*. When using a pair of machine guns to engage a linear target with depth, the initial point of aim and the extent of manipulation for both gunners is the same as those prescribed for linear targets (Figure 5-17).

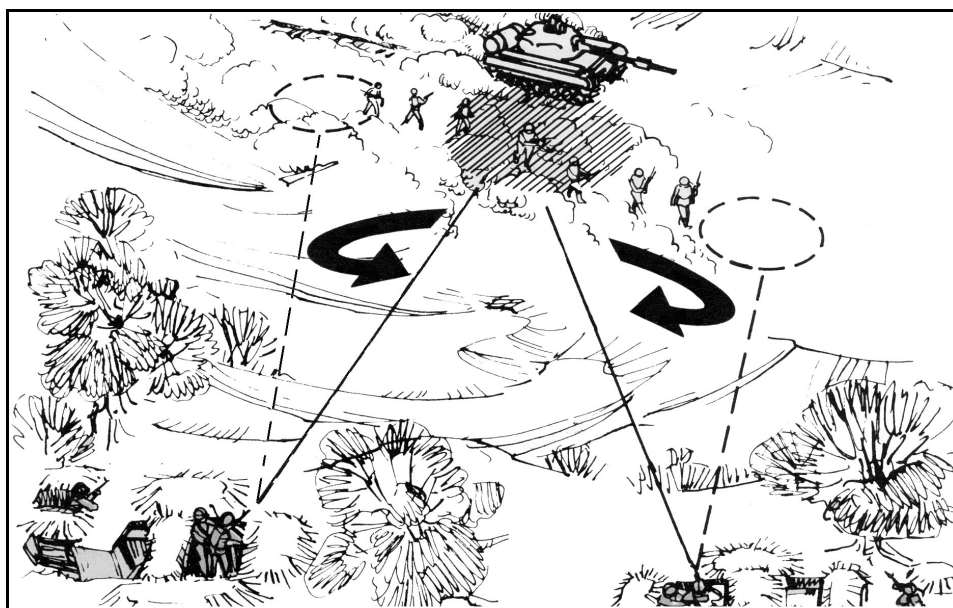


Figure 5-17. Engagement of linear target with depth with a pair of gunners.

5-12. TARGET ENGAGEMENT DURING LIMITED VISIBILITY

Gunners have problems detecting and identifying targets during limited visibility. The leader's ability to control the fires of his weapons is also reduced, therefore, he may instruct the gunners to fire without command when targets present themselves.

a. Gunners should engage targets only when they can identify the targets, unless ordered to do otherwise. For example, if one gunner detects a target and engages it, the other gunner observes the area fired upon and adds his fire only if he can identify the target or if ordered to fire.

b. Tracer ammunition helps a gunner engage targets during limited visibility and should be used, if possible. If firing unaided, gunners must be trained to fire low at first and adjust upward. This overcomes the tendency to fire high.

c. When two or more gunners are engaging linear targets, linear targets with depth, or deep targets, they do not engage these targets as they would when visibility is good. With limited visibility, the center and flanks of these targets may not be clearly defined; therefore, each gunner observes his tracers and covers what he believes to be the entire target.

5-13. OVERHEAD FIRE

Fire delivered over the heads of friendly soldiers is called overhead fire. It is used during training **ONLY AFTER SOLDIER SAFETY IS CHECKED AND VERIFIED**. The terrain and visibility dictate when overhead fire can be delivered safely. (See AR 385-63 for a complete summary of training safety requirements.) Overhead fire is delivered with any machine gun mounted on a tripod because the machine guns provide greater stability and accuracy, and because vertical mil angles can be measured by using the elevating mechanism.

DANGER

OVERHEAD FIRE CANNOT BE SAFELY DELIVERED ON A TARGET AT GREATER THAN 850 METERS FROM THE MACHINE GUN, AND IT IS NOT DELIVERED OVER LEVEL OR UNIFORMLY SLOPING TERRAIN. IT CAN CAUSE DEATH OR INJURY.

a. Ideally, overhead fire is delivered when there is a depression in the terrain between the machine gun position and the target. The depression should place the gunner's line of aim well above the heads of friendly soldiers.

b. The squad leader normally controls overhead fire. He lifts or shifts the fire when the friendly soldiers reach an imaginary line, parallel to the target, where further fire would cause casualties to friendly soldiers. This imaginary line is called the "safety limit." The leader of the friendly soldiers may direct lifting of fire by prearranged signals transmitted by radio, wire, or visual means. The safety limit can be determined by observing the fire or by using the gunner's rule (Figure 5-18).

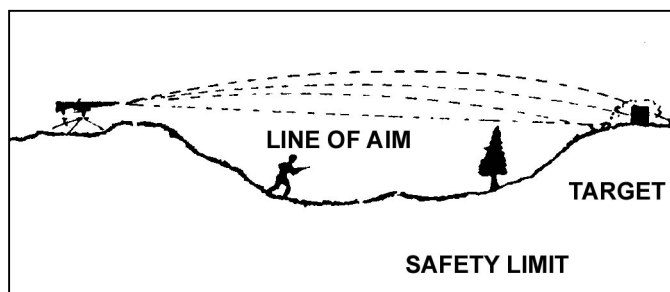


Figure 5-18. Overhead fire safety limit.

(1) To determine the safety limit by observation, the leader uses binoculars to see how close the fire is to advancing friendly soldiers.

(2) A safety limit can be selected by using the gunner's rule before the weapon is fired. The accuracy and safety of this method depends on the machine gun being zeroed and the range to the target being known. The gunner's rule is used only when the target is between 350 and 850 meters from the machine gun. The gunner's rule consists of the following procedure.

- (a) Determine the range to the target and set the range on the rear sight.
 - (b) Aim the machine gun to hit the target.
 - (c) Set the rear sight to 1,000 meters.
 - (d) Depress the muzzle 10 mils by using the elevating handwheel (one click equals 1 mil).
 - (e) Look through the rear sight and note the point where the new line of aim strikes the ground. (An imaginary line drawn through this point and parallel to the target is the safety limit.)
 - (f) Reset the range to the target on the rear sight, aim on the target, and prepare to fire.
 - (g) Cease or shift fire when soldiers reach the safety limit.
- c. The following safety measures **MUST** be applied when delivering overhead fire.
- (1) Firmly emplace the tripod mount.
 - (2) Use field-expedient depression stops to prevent the muzzle from accidentally being lowered below the safety limit.
 - (3) Do not deliver overhead fire through trees.
 - (4) Inform commanders of friendly soldiers when fire is to be delivered over their heads.
 - (5) Ensure that all members of the crew are aware of the safety limit.
 - (6) Do not deliver overhead fire if the range from the machine gun to the target is less than 350 meters or more than 850 meters.
 - (7) Do not use a barrel that is badly worn.
 - (8) During training exercises, do not aim any machine gun where their trajectories will cross at a point directly over the heads of friendly soldiers. See AR 385-63 and local safety regulations concerning overhead fire.

5-14. DEFILADE POSITIONS

A machine gun is in defilade when the weapon and its crew are completely behind terrain that masks them from the enemy (usually on the reverse slope of a hill). Fire, from a defilade position, is controlled by an observer (the leader or a member of the crew who can see the target) that is in a position near the machine gun. (Figure 5-19.)

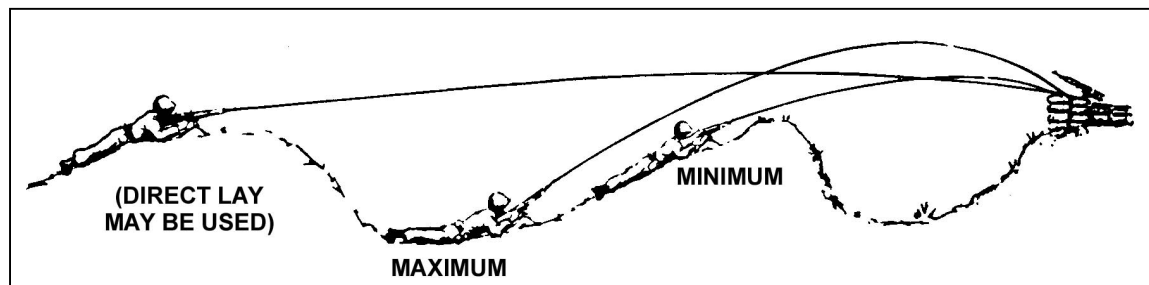


Figure 5-19. Defilade positions.

a. The machine gun must fire up and over the hill. Its fire must be observed and adjusted by a crewmember that can observe the target from a position on a flank or to the rear of the weapon (on higher ground). A defilade position allows little opportunity to engage new targets. The tripod mount is used when firing from defilade, because the gunner can measure vertical angles with it. This makes changes in elevation for adjusting fire easier, and if data is determined during daylight, the crew can fire from the same position after dark. A machine gun is in partial defilade when it is positioned just back of the crest of a hill, so that the crest provides some protection from enemy direct-fire and the machine guns are still able to engage its target by direct-lay techniques.

(1) *Advantages.*

- The crew has cover and concealment from enemy direct-fire weapons.
- The crew has some freedom of movement near the position.
- Control and supply are easier.
- The smoke and flash of the machine gun are hidden from the enemy.

(2) *Disadvantages.*

- Rapidly moving ground targets are hard to engage, because adjustment of fire must be made by using an observer.
- Targets close to the mask usually cannot be engaged.
- Final protective line is hard to understand.

b. The essential elements in the engagement of a target from a defilade position are mask clearance, direction, and adjustment of fire. If possible, a minimum mask clearance (minimum elevation) is determined for the entire sector of fire, however, a mask clearance for each target may be necessary (due to the slope of the mask). The elevation readings obtained using the methods below give the minimum elevation for the sector or target(s). The minimum elevation should be recorded on a range card.

(1) If the mask is 300 meters or less from the machine gun position, the gunner places a 300-meter range setting on the rear sight, aims on the top of the mask and adds 3 mils (clicks) of elevation with the elevating handwheel.

(2) If the mask is over 300 meters from the machine gun position, the gunner places the range setting to the mask on the rear sight, aims on the top of the mask, and adds 3 mils (clicks) of elevation.

c. The observer places himself to the rear of the machine gun on the gun-to-target line and in a position where he can see the machine gun and the target. He aligns the machine gun for general direction by directing the gunner to shift the machine gun until it is aligned on the target. A prominent terrain feature or landmark visible to the gunner through his sights is selected as an aiming point. This aiming point should be at a greater range than the target and at a higher elevation. When laying the machine gun on the aiming point, the range setting on the rear sight must correspond to the range to the target. (Figure 5-20.)

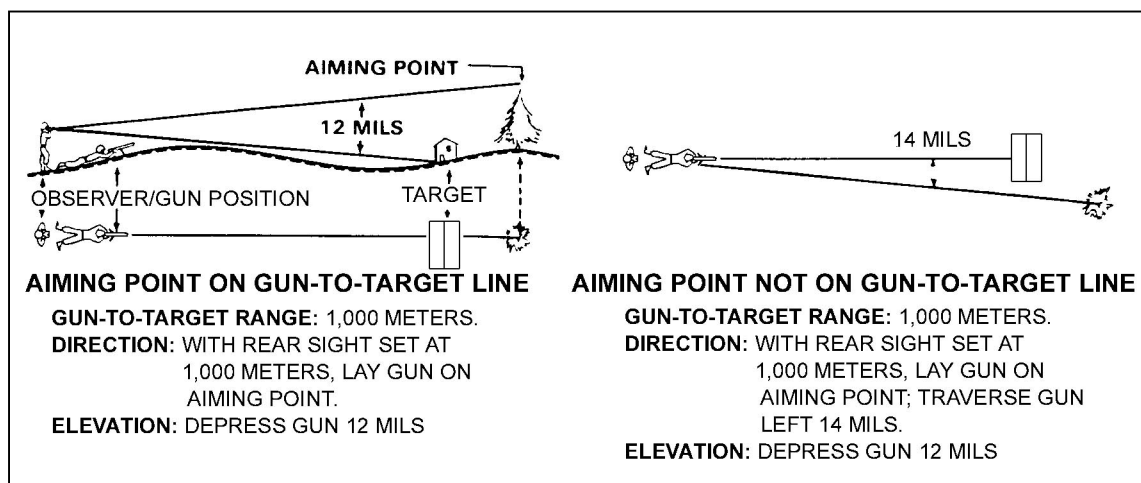


Figure 5-20. Observer adjusting fire.

(1) If the aiming point is on the gun-to-target line, the gun is laid on the aiming point and is thereby aligned for direction.

(2) If the aiming point is not on the gun-to-target line, the horizontal distance in mils is determined using the best means available (usually binoculars) and announced to the gunner. This measured distance is then set with the traversing handwheel.

d. The observer measures the vertical distance from the aiming point to the base of the target using the best means available and directs the gunner to depress the muzzle of the machine gun the number of mils measured. The machine gun should now be laid to hit the target.

Section IV. PREDETERMINED FIRES

Predetermined fires organize the battlefield for the gunners. They allow the leader and gunner to select potential targets or target areas that will most likely be engaged or that have tactical significance. This includes dismounted enemy avenues of approach, likely positions for automatic weapons, and probable enemy assault positions. The gunners do this by using sectors of fire, final protective lines, or a principal direction of fire and selected target areas. This preparation maximizes the effectiveness of the machine gun during good as well as limited visibility. It enhances fire control by reducing the time required to identify targets, determine range, and manipulate the weapon onto the target. Abbreviated fire commands and previously recorded data enable the gunner to aim or adjust fire on the target quickly and accurately. Selected targets should be fired on in daylight whenever practical to confirm data. The range card identifies the targets and provides a record of firing data.

5-15. TERMINOLOGY

Several terms are associated with predetermined fire that every gunner needs to know.

a. **Sector of Fire.** A sector of fire is an area to be covered by fire that is assigned to an individual, a weapon, or a unit. Gunners are normally assigned a primary and a secondary sector of fire.

b. **Final Protective Fire.** An FPF is an immediately available prearranged barrier of fire to stop enemy movement across defensive lines or areas.

c. **Final Protective Line.** An FPL is a predetermined line along which grazing fire is placed to stop an enemy assault. If an FPL is assigned, the machine gun is sighted along it except when other targets are being engaged. An FPL becomes the machine gun's part of the unit's final protective fires. An FPL is fixed in direction and elevation; however, a small shift for search must be employed to prevent the enemy from crawling under the FPL and to compensate for irregularities in the terrain or the sinking of the tripod legs into soft soil during firing. Fire must be delivered during all conditions of visibility.

d. **Principal Direction of Fire.** A PDF is a direction of fire assigned priority to cover an area that has good fields of fire or has a likely dismounted avenue of approach. It also provides mutual support to an adjacent unit. Machine guns are sighted using the PDF if an FPL has not been assigned. If a PDF is assigned and other targets are not being engaged, machine guns remain on the PDF. A PDF has the following characteristics.

(1) It is used only if an FPL is not assigned; it then becomes the machine gun's part of the unit's final protective fires.

(2) When the target has width, direction is determined by aiming on one edge of the target area and noting the amount of traverse necessary to cover the entire target.

(3) The gunner is responsible for the entire wedge-shaped area from the muzzle of the weapon to the target, but elevation may be fixed for a priority portion of the target.

e. **Grazing Fire.** A good FPL covers the maximum area with grazing fire. Grazing fire can be obtained over various types of terrain out to a maximum of 600 meters. To obtain the maximum extent of grazing fire over level or uniformly sloping terrain, the gunner sets the rear sight at 600 meters. He then selects a point on the ground that he estimates to be 600 meters from the machine gun, and he aims, fires, and adjusts on that point. To prevent enemy soldiers from crawling under grazing fire, he searches

(downward) by lowering the muzzle of the weapon. To do this, the gunner separates his elbows.

f. **Dead Space.** The extent of grazing fire and the extent of dead space may be determined in two ways. In the preferred method, the machine gun is adjusted for elevation and direction. A member of the squad then walks along the FPL while the gunner aims through the sights. In places where the soldier's waist (midsection) falls below the gunner's point of aim, dead space exists. Arm-and-hand signals must be used to control the soldier who is walking and to obtain an accurate account of the dead space and its location. Another method is to observe the flight of tracer ammunition from a position behind and to the flank of the weapon.

g. **Fire Control.** Predetermined targets, including the FPL or PDF, are engaged on order or by SOP. The signal for calling for these fires is normally stated in the defense order. Control these predetermined targets by using arm-and-hand signals, voice commands, or pyrotechnic devices. Gunners fire the FPL or PDF at the sustained rate of fire unless the situation calls for a higher rate. When engaging other predetermined targets, the sustained rate of fire is also used unless a different rate is ordered.

h. **Primary Sector of Fire.** The primary sector of fire is the area to be covered by an individual or unit.

i. **Secondary Sector of Fire.** The secondary sector of fire is the same area covered by the same individual or unit after it has moved to a different location.

5-16. RANGE CARD

The standard range card (DA Form 5517-R) provides a record of firing data and aids defensive fire planning. (See FM 7-8 for a reproducible copy of this form.) Its use enhances fire control and rapid engagement of predetermined targets. It is also used in estimating ranges to other targets within the sector of fire. Each gunner makes two copies—one for his position and one for the squad leader. The squad leader uses his copy to prepare his sector sketch. The range card is prepared immediately upon occupation and is constantly revised. Each range card contains the following:

- Weapon symbol (Figure 5-21, page 5-18).
- Sector of fire.
- PDF or FPL.
- Range, azimuth, and number label to predetermined targets.
- Dead space.
- Distance and azimuth from a known point or eight-digit grid coordinate (reference point).
- Magnetic north arrow.
- Data section.

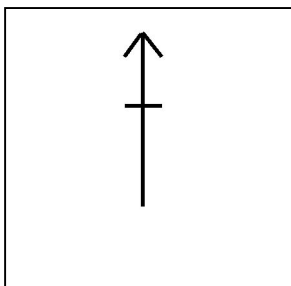


Figure 5-21. M249/M60 and M240B machine gun symbol.

a. **Procedures.** The machine gun is placed in the tripod-supported mode in the position it will be fired. The machine gun symbol is sketched on the range card pointing toward the most dangerous target in the sector.

(1) If using the FPL, the gunner aims the machine gun along the FPL. This procedure will also be either the left or right limit of the sector of fire. To set the limit, he slides the T&E mechanism all the way to the left or right end of the traversing bar. Then, he moves the tripod until the barrel lines up on the FPL. The sector of fire with the FPL along one limit is now prepared. The FPL is always labeled target number 1.

(2) To determine the range for all targets in the sector, the gunner ensures each circle, except the first one, represents 100 meters. Since the lowest setting on the M249 and M60 is 300 meters and the M240B is 200 meters, the first circle represents 200 or 300 meters. He indicates this on the range card in the data section just below the circles. On the top half of the range card, the gunner draws the left or right limits from the weapon position to the maximum effective range of the machine gun.

(3) If the FPL is assigned, the machine gun symbol is drawn along that line (left or right limit) (Figure 5-22). The extent of grazing fire is determined. A shaded blade is sketched on the inside of the FPL to represent the extent of the grazing fire. If there is dead space along the FPL, it is shown by breaks in the shaded area. The ranges to the *near* and *far* edges of the dead space are recorded above the FPL, and the *extent* of the grazing fire is recorded along the FPL. The magnetic azimuth of the FPL is determined and recorded below the shaded blade representing the FPL. The elevation reading and other data are recorded in the data section.

(4) If an FPL is not assigned, the gunner locks the T&E mechanism on 0 on the traversing bar scale and shifts the tripod until the muzzle points to the PDF. The machine gun symbol is sketched in the center of the left and right limits pointing in the direction of the PDF (Figure 5-23, page 5-20).

(5) The opposite primary sector limit is drawn. If a target is along this line, the target information is added to the data section. If the opposite side of the traversing bar cannot be used to mark the opposite side of the primary sector, a direction reading must be recorded in the sketch section.

(6) Next, the left and right limits of the secondary sector are drawn using a broken line. The area between the primary and secondary sector is labeled dead space.

(7) An arrow is drawn in the magnetic north block (upper right hand corner) pointing in the direction of magnetic north.

STANDARD RANGE CARD <small>For use of this form see FM 7-8 The proponent agency is TRADOC.</small>					
SQD <u>2</u> PLT <u>1</u> CO <u>C</u>	May be used for all types of direct fire weapons.				 MAGNETIC NORTH
DATA SECTION					
POSITION IDENTIFICATION				DATE <u>8 AUG 94</u>	
WEAPON <u>M60 #1</u>				EACH CIRCLE EQUALS <u>100 METERS</u>	
NO.	DIRECTION/DEFLECTION	ELEVATION	RANGE	AMMO	DESCRIPTION
1		+50/3	600		FPL
2	R350°	+50/45	600		LONE TREE
3	L300°	0/20	650		TRAIL JUNCTION
REMARKS:					

DA Form 5517-R, FEB 86

Figure 5-22. Final protective line.

STANDARD RANGE CARD <small>For use of this form see FM 7-8 The proponent agency is TRADOC.</small>					
SQD <u>2</u> PLT <u>2</u> CO <u>C</u>	May be used for all types of direct fire weapons.				 MAGNETIC NORTH
DATA SECTION					
POSITION IDENTIFICATION				DATE <u>8 AUG 94</u>	
WEAPON <u>M60 #2</u>			EACH CIRCLE EQUALS <u>100 METERS</u>		
NO.	DIRECTION/DEFLECTION	ELEVATION	RANGE	AMMO	DESCRIPTION
1	L 25°	0/24	700		PDF (ROAD JUNCTION)
2	R 60°	-50/15	500		BARN
3	L 29°	-50/40	400		HEDGE ROW
REMARKS:					

DA Form 5517-R, FEB 86

Figure 5-23. Principal direction of fire.

(8) The position is oriented with a prominent terrain feature (recognizable on a map) by obtaining a magnetic azimuth to or from the terrain feature to the position. A line is

drawn between these two points. Arrow barbs are drawn along this line pointing in the direction the magnetic azimuth was taken. The magnetic azimuth is recorded in mils or degrees below the line. If a prominent terrain feature is not available, identify the position by using an eight-digit grid coordinate. The grid coordinate is recorded below the position on the range card.

(9) The gunner's number, unit designation (SQD, PLT, CO), and date are recorded in the upper left-hand corner. For security, do not use a unit designation higher than a company.

(10) Targets within the sector are identified. A symbol is drawn to represent the target in the appropriate place within the sector of fire. Targets in the primary sector are shown by numbers and enclosed in circles. An FPL, when assigned, is always labeled target Number 1. Other targets are assigned subsequent numbers in order of tactical importance.

(a) Wide targets in the primary sector are usually engaged in the center; however, the initial burst can be positioned anywhere the leader designates. The gunner measures the target width and records it in the data section; for example, TW-20 (target width is 20 mils). The gunner lays on the point on the target where the initial burst will be placed, and traverses to one edge of the target, while counting the clicks. He records the number of clicks he traverses and the direction he moves the muzzle; for example, TW-20/R7 (target width, 20 mils; right 7 clicks). After the initial burst, the gunner traverses 7 clicks to the right edge of the target and back to the left 20 clicks to cover the target area. To lay on the left edge of the target, the gunner records TW-20/R20.

(b) When field expedients are used with the machine gun to engage targets, they are sketched above the drawing of the target. Predetermined targets in the secondary sector are sketched on the range card and ranges to these targets are recorded below the targets but not in the data section. Field expedients should be used for targets in the secondary sector.

b. **Field Expedients.** When laying the machine gun for predetermined targets, the gunner can use field expedients as a means of engaging targets when other sources are not available. These methods are not as effective as the traversing bar and T&E mechanism method.

(1) *Base Stake Technique.* A base stake is used to define sector limits and may provide the lay for the FPL or predetermined targets along a primary or secondary sector limit. This technique is effective in all visibility conditions. The gunner uses the following steps:

(a) Defines the sector limits by laying the gun for direction along one sector limit and by emplacing a stake along the outer edge of the folded bipod legs. Rotates the legs slightly on the receiver, so that the gunner takes up the "play". Uses the same procedure for placing a stake along the opposite sector limit.

(b) Lays the machine gun along the FPL by moving the muzzle of the machine gun to a sector limit. Adjusts for elevation by driving a stake into the ground, so that the top of the stake is under the gas cylinder extension, allowing a few mils of depression to cover irregularities in the terrain.

(c) Lays the machine gun to engage other targets within a sector limit, in a primary sector by using the procedure described previously, except keeps the elevation fixed.

(2) *Notched-Stake or Tree-Crotch Technique.* The gunner uses the notched-stake or tree-crotch technique (Figure 5-24, page 5-22) with the bipod mount to engage

predetermined targets within a sector or to define sector limits. This technique is effective during all conditions of visibility, and it requires little additional material. The gunner uses the following steps:

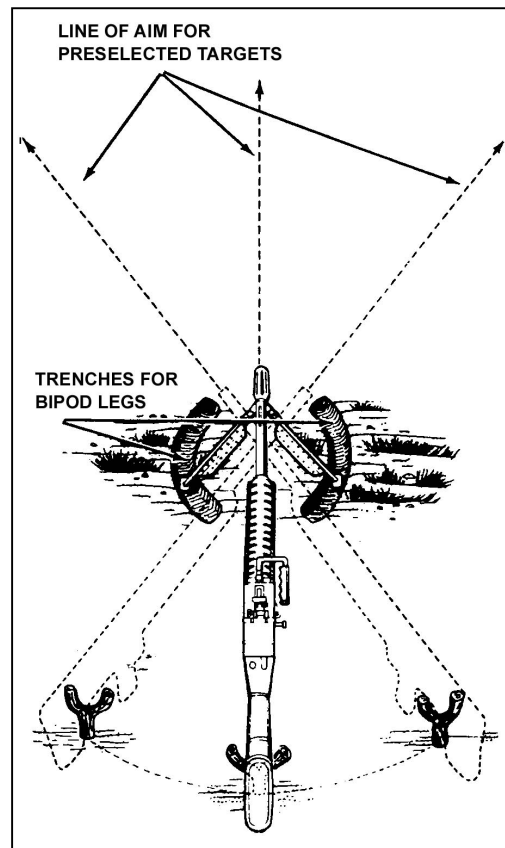


Figure 5-24. Notched-stake or tree-crotch technique.

(a) Drives either a notched stake or tree crotch into the ground where selected targets are anticipated. Places the stock of the machine gun in the nest of the stake or crotch and adjusts the weapon to hit the selected targets and to define his sector limits.

NOTE: If notched stakes and crotches are not available, tent poles can be used. It requires four poles for the left and right limits and additional poles for target areas. The gunner drives two poles in the ground in the shape of an X and then places the stock within that X as described with stakes and crotches.

(b) Digs shallow, curved trenches or grooves for the bipod feet. (These trenches allow for rotation of the bipod feet as the gunner moves the stock from one crotch or stake to another.)

(3) *Horizontal Log or Board Technique.* This technique is used with the bipod or tripod mount to mark sector limits and engage wide targets. This technique is good for all visibility conditions. It is best suited for flat, level terrain. The gunner uses the following steps:

(a) Using a bipod-mounted machine gun, places a log or board beneath the stock of the weapon, so that the stock can slide across it freely. Digs shallow, curved trenches or grooves for the bipod feet to allow rotation of the feet as he moves the stock along the log or board. (The gunner may mark the sector limits by notching or placing stops on the log or board. The gunner uses the bipod firing position and grip.)

(b) Using a tripod-mounted machine gun, places a log or board beneath the barrel, positioning it so that the barrel, when resting on the log or board is at the proper elevation to obtain grazing fire. Marks the sector limits, when appropriate, as described for the bipod in the preceding paragraph. (This technique is used only if a T&E mechanism is not available.)

Section V. FIRE CONTROL

Fire control includes all actions of the leader and soldiers in planning, preparing, and applying fire on a target. The leader selects and designates targets. He also designates the midpoint and flanks or ends of a target, unless they are obvious to the gunner. The gunner fires at the instant desired. He then adjusts fire, regulates the rate of fire, shifts from one target to another, and ceases fire. When firing, the gunner should continue to fire until the target is neutralized or until signaled to do otherwise by the leader.

5-17. METHODS OF FIRE CONTROL

The noise and confusion of battle may limit the use of some of these methods; therefore, the leader must select a method or combination of methods that will accomplish the mission.

a. **Oral.** This can be an effective method of control, but sometimes the leader may be too far away from the gunner, or the noise of the battle may make it impossible for him to hear. The primary means of the oral fire control method is the issuance of a fire command.

b. **Arm-and-Hand Signals.** This is an effective method when the gunner can see the leader. All gunners must know the standard arm-and-hand signals. The leader gets the gunner's attention and then points to the target. When the gunner returns the READY signal, the leader commands FIRE.

c. **Prearranged Signals.** These are either visual or sound signals such as casualty-producing devices, pyrotechnics, whistle blasts, or tracers. These signals should be included in SOPs. If the leader wants to shift fire at a certain time, he gives a prearranged signal such as smoke or pyrotechnics. Upon seeing the signal, the gunner shifts his fire to a prearranged point.

d. **Personal Contact.** In many situations, the leader must issue orders directly to individual soldiers and is used more than any other method by small-unit leaders. The leader must use maximum cover and concealment to keep from disclosing the position or himself.

e. **Range Cards.** When using this method of fire control, the leader must ensure all range cards are current and accurate. Once this is accomplished, the leader may designate certain targets for certain weapons with the use of limiting stakes or with fire commands. He should also designate no-fire zones or restricted fire areas to others. The key factor, in this method of fire control, is that gunners must be well-disciplined and pay attention to detail.

f. **Standing Operating Procedures.** SOPs are actions to be executed without command that are developed during the training of the squads. Their use eliminates many commands and simplifies the leader's fire control. SOPs for certain actions and commands can be developed to make gunners more effective. Some examples follow:

(1) *Observation.* The gunners continuously observe their sectors.

(2) *Fire.* Gunners open fire without command on appropriate targets that appear within their sectors.

(3) *Check.* While firing, the gunners periodically check with the leader for instructions.

(4) *Return Fire.* The gunners return enemy fire without order, concentrating on enemy automatic weapons.

(5) *Shift Fire.* Gunners shift their fires without command when more dangerous targets appear.

(6) *Rate of Fire.* When gunners engage a target, they initially fire at the rate necessary to gain and maintain fire superiority.

(7) *Mutual Support.* When two or more gunners are engaging the same target and one stops firing, the other increases the rate of fire and covers the entire target. When only one gunner is required to engage a target and the leader has alerted two or more, the gunner not firing aims on the target and follows the movements of the target. This is so that he can fire instantly should the other machine gun malfunction or cease fire before the target has been eliminated.

5-18. FIRE COMMANDS

A fire command is given to deliver effective fire on a target quickly and without confusion. When the leader decides to engage a target that is not obvious to the squad, he must provide them with the information they need to effectively engage the target. He must alert the soldiers; give a target direction, description, and range; name the method of fire; and give the command to fire. There are initial fire commands and subsequent fire commands.

a. **Initial Fire Commands.** Initial fire commands are given to adjust onto the target, change the rate of fire after a fire mission is in progress, interrupt fire, or terminate the alert.

b. **Elements.** Fire commands for all direct-fire weapons follow a pattern that includes similar elements. There are six elements in the fire command for the machine gun: alert, direction, description, range, method of fire, and command to open fire. The gunners repeat each element of fire command as it is given.

(1) *Alert.* This element prepares the gunners for further instructions. The leader may alert both gunners in the squad and may have only one fire, depending upon the situation. To alert and have both gunners fire, the leader announces, "Fire mission." If he desires to alert both gunners but have only one fire, he announces, "Gun number one, fire mission." In all cases, upon receiving the alert, the gunners load their machine guns and place them on FIRE.

(2) *Direction.* This element indicates the general direction to the target and may be given in one or a combination of the following methods.

(a) Orally. The leader orally gives the direction to the target in relation to the position of the gunner (for example, FRONT, LEFT FRONT, RIGHT FRONT).

(b) Pointing. The leader designates a small or obscure target by pointing with his finger or aiming with a weapon. When he points with his finger, a soldier standing behind him should be able to look over his shoulder and sight along his arm and index finger to locate the target. When aiming his weapon at a target, a soldier looking through the sights should be able to see the target.

(c) Tracer Ammunition. Tracer ammunition is a quick and sure method of designating a target that is not clearly visible. When using this method, the leader should first give the general direction to direct the gunner's attention to the target area. To prevent the loss of surprise when using tracer ammunition, the leader does not fire until he has given all elements of the fire command except the command to fire. The leader may fire his individual weapon. The firing of the tracer(s) then becomes the last element of the fire command, and it is the signal to open fire.

NOTE: Soldiers must be aware that with the night vision device, temporary blindness "white out" may occur when firing tracer ammunition at night or when exposed to other external light sources. Lens covers may reduce this effect.

EXAMPLE
FIRE MISSION
FRONT
FIVE HUNDRED
WATCH MY TRACER(S)

(d) Reference Points. Another way to designate obscure targets is to use easy-to-recognize reference points. All leaders and gunners must know terrain features and the terminology used to describe them (FM 21-26). When using a reference point, the word "reference" precedes its description. This is done to avoid confusion. The general direction to the reference point should be given.

EXAMPLE

FIRE MISSION
FRONT
REFERENCE: BUNKER, CENTER MASS
TARGET: TROOPS EXTENDING SHORT ONE HUNDRED, OVER
ONE HUNDRED
FOUR HUNDRED
FIRE

(Sometimes the reference point may be outside the target area).

EXAMPLE

FIRE MISSION
FRONT
REFERENCE: BUNKER, RIGHT FOUR FINGERS, CENTER MASS
TARGET: TROOPS EXTENDING SHORT ONE HUNDRED, OVER
ONE HUNDRED
THREE HUNDRED
SEARCH
AT MY COMMAND
FIRE

(Sometimes a target must be designated by using successive reference points).

EXAMPLE

GUN NUMBER ONE, FIRE MISSION
RIGHT FRONT
REFERENCE: RED-ROOFED HOUSE, LEFT TO HAYSTACK, LEFT TO
BARN

(Finger measurements can be used to direct the gunner's attention to the right or left of reference points).

EXAMPLE

FIRE MISSION
LEFT FRONT
REFERENCE: CROSSROADS, RIGHT FOUR FINGERS

(3) *Description.* The target description creates a picture of the target in the minds of the gunners. To properly apply their fire, the soldiers must know the type of target they are to engage. The leader should describe it briefly. If the target is obvious, no description is necessary.

(4) *Range.* The leader always announces the estimated range to the target. The range is given, so the gunner knows how far to look for the target and what range setting to put on the rear sight. Range is announced in meters; however, since the meter is the standard unit of range measurement, the word "meters" is not used. With machine gun's, the range is determined and announced to the nearest hundred or thousand (in other words, THREE HUNDRED, or ONE THOUSAND).

EXAMPLE

FIRE MISSION
FRONT
REFERENCE: KNOCKED-OUT TANK, LEFT TWO FINGERS
TARGET: TROOPS
THREE HUNDRED

(5) *Method of Fire.* This element includes manipulation and rate of fire. Manipulation prescribes the class of fire with respect to the weapon. It is announced as

FIXED, TRAVERSE, SEARCH, or TRAVERSE AND SEARCH. Rate controls the volume of fire (sustained, rapid, and cyclic). Normally, the gunner uses the sustained rate of fire. The rate of fire is omitted from the fire command. The method of fire for the machine gun is usually 3- to 5-round bursts (M249) and 6- to 9-round bursts (M60/M240B).

EXAMPLE

FIRE MISSION
FRONT
REFERENCE: KNOCKED-OUT TANK, LEFT TWO FINGERS
TARGET: TROOPS
THREE HUNDRED
TRAVERSE

(6) *Command to Open Fire.* When fire is to be withheld so that surprise fire can be delivered on a target or to ensure that both gunners open fire at the same time, the leader may preface the command to commence firing with AT MY COMMAND or AT MY SIGNAL. When the gunners are ready to engage the target, they report READY to the leader. The leader then gives the command FIRE at the specific time desired.

EXAMPLE

FIRE MISSION
FRONT
TROOPS
FOUR HUNDRED
AT MY COMMAND or AT MY SIGNAL (The leader pauses until the gunners are ready and fire is desired.)
FIRE (The gunners fire on prearranged signal.)

If immediate fire is required, the command FIRE is given without pause and the gunners fire as soon as they are ready.

c. **Subsequent Fire Commands.** These fire commands are used to make adjustments in direction and elevation, to change rates of fire after a fire mission is in progress, to interrupt fires, or to terminate the alert. If the gunner fails to properly engage a target, the leader must promptly correct him by announcing or signaling the desired changes. When these changes are given, the gunner makes the corrections and resumes firing without further command.

(1) Adjustments in direction and elevation with the machine gun are always given in meters; one finger is used to indicate 1 meter and so on. Adjustment for direction is given first. For example: RIGHT ONE ZERO METERS or LEFT FIVE METERS. Adjustment for elevation is given next. For example: ADD FIVE METERS or DROP ONE FIVE METERS. These changes may be given orally or with arm-and-hand signals.

(2) Changes in the rate of fire are given orally or by arm-and-hand signals.

(3) To interrupt firing, the leader announces "Cease fire," or he signals to cease fire. The gunners remain on the alert. They resume firing when given the command FIRE.

(4) To terminate the alert, the leader announces "Cease fire, end of mission."

d. **Doubtful Elements and Corrections.** When the gunner is in doubt about any element of the fire command, he replies "Say again range, target." The leader then announces "The command was," repeats the element in question, and continues with the fire command.

(1) When the leader makes an error in the initial fire command, he corrects it by announcing "Correction," and then gives the corrected element.

EXAMPLE
FIRE MISSION
FRONT
TROOPS
SIX HUNDRED
CORRECTION
THREE HUNDRED
TRAVERSE
AT MY COMMAND

(2) When the leader makes an error in the subsequent fire command, he may correct it by announcing "Correction," and then repeating the entire subsequent fire command.

EXAMPLE
LEFT FIVE METERS, DROP ONE METER
CORRECTION
LEFT FIVE METERS, DROP ONE HUNDRED METERS

e. **Abbreviated Fire Commands.** Fire commands need not be complete to be effective. In combat, the leader gives only the elements necessary to place fire on a target quickly and without confusion. During training, however, he should use all of the elements to get gunners in the habit of thinking and reacting properly when a target is to be engaged. After the gunner's initial training in fire commands, he should be taught to react to abbreviated fire commands, using one of the following methods.

(1) *Oral.* The leader may want to place the fire of one machine gun on an enemy machine gun.

EXAMPLE
GUN NUMBER ONE, FIRE MISSION
MACHINE GUN
FOUR HUNDRED
FIRE

(2) *Arm-and-Hand Signals.* Battlefield noise and the distance between the gunner and the leader often make it necessary to use arm-and-hand signals to control fire (Figure 5-25). When an action or movement is to be executed by only one of the gunners, a preliminary signal is given to that gunner only. The following are commonly used signals for fire control.

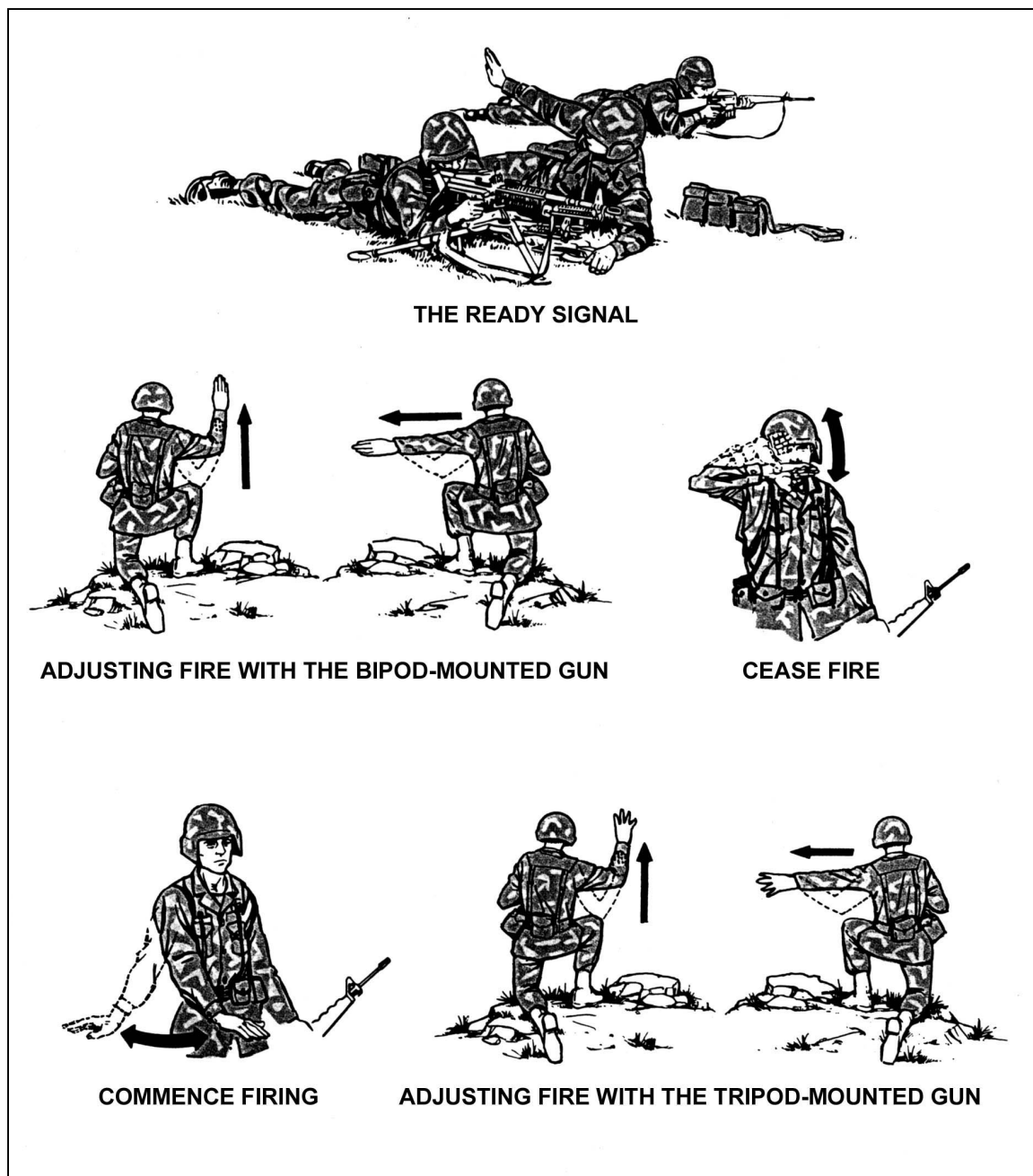


Figure 5-25. Arm-and-hand signals.

(a) Ready. The gunner indicates that he is ready to fire by yelling "Up" or having the assistant gunner raise his hand above his head toward the leader.

(b) Commence Firing or Change Rate of Firing. The leader brings his hand (palm down) to the front of his body about waist level, and moves it horizontally in front of his body. To signal an increase in the rate of fire, he increases the speed of the hand movement to signal slower fire, and he decreases the speed of the hand movement.

(c) Change Direction or Elevation. The leader extends his arm and hand in the new direction and indicates the amount of change necessary by the number of fingers

extended. The fingers must be spread, so the gunner can easily see the number of fingers extended. Each finger indicates 1 meter of change for the weapon. If the desired change is more than 5 meters, the leader extends his hand the number of times necessary to indicate the total amount of change. For example, *right nine* would be indicated by extending the hand once with five fingers showing and a second time with four fingers showing for a total of nine fingers.

(d) Interrupt or Cease Firing. The leader raises his arm and hand (palm outward) in front of his forehead and brings it downward sharply.

(e) Other Signals. The leader can devise other signals to control his weapons. A detailed description of arm-and-hand signals is given in FM 21-60.

Section VI. RANGE DETERMINATION

During combat, ranges are seldom known. Poor visibility and damp ground often make adjustment of fire by observation difficult if not impossible. Therefore, correct range determination is critical for accurate effective fire. Range estimation and lateral distance measurements are two methods used to determine the range to the target.

5-19. RANGE ESTIMATION

Range estimation is determining the distance between two points. In most situations, one of these points is the gunner's own position; the other point may be a target or prominent terrain feature. The gunner must accurately determine the range to set the sights and effectively fire on a target with the first burst.

a. Not only does the accurate estimation of range affect marksmanship, but it is also required in the reporting of information and the adjustment of artillery and mortar fire (Table 5-1).

FACTORS AFFECTING RANGE ESTIMATION	FACTORS CAUSING UNDERESTIMATION	FACTORS CAUSING OVERESTIMATION
The clearness of outline and details of the target.	When most of the target is visible and offers	When only a small portion of the target is small in relation to its surroundings.
Nature of terrain or position of the gunner.	When looking across a depression that is mostly hidden from view. When looking downward from high ground. When looking down a straight, open road or along a railroad. When looking over uniform surfaces like water, snow, desert, or grain fields.	When looking across a depression that is totally visible. When looking from low ground toward high ground. When vision is narrowly confined as in streets, draws, or forest trails.

Table 5-1. Factors of range estimation.

FACTORS AFFECTING RANGE ESTIMATION	FACTORS CAUSING UNDERESTIMATION	FACTORS CAUSING OVERESTIMATION
Light and atmosphere.	<p>In bright light or when the sun is shining from behind the gunner.</p> <p>When the target is in sharp contrast with the silhouette because of its size, shape, or color.</p> <p>When seen in the clear air of high altitudes.</p>	<p>In poor light such as dawn and dusk; in rain, snow, fog; or when the sun is in the gunner's eyes.</p> <p>When the target blends into the background or terrain.</p>

Table 5-1. Factors of range estimation (continued).

b. There are several methods of estimating range. They include measuring distance on a map, pacing the distance between two points, and using an optical range finder. The gunner does not usually have a map and rarely has access to an optical range finder. He can pace the distance between two points if the enemy is not within range. Firing rounds to determine the range is not desirable, since it may reveal your position to the enemy. Most of the time, the gunner must use techniques that do not require equipment and can be used without exposing himself or revealing his position. There are two methods that meet these requirements: the appearance-of-objects and the 100-meter-unit-of-measure.

(1) *Appearance-of-Objects Method.* This method is a means of estimating range by the size and other characteristic details of the object.

(a) This is a common method of determining distances and is used most often. For example, a motorist trying to pass another car must judge the distance of oncoming vehicles based on his knowledge of how vehicles appear at various distances. In this example, the motorist is not interested in precise distances but only in having enough road space to safely pass the car. Suppose, however, the motorist knew that at a distance of 1 kilometer, an oncoming vehicle appeared to be 1 centimeter between headlights. Then, anytime he saw other oncoming vehicles that fit these dimensions, he would know they were about 1 kilometer away. This technique can be used by a gunner to estimate ranges on the battlefield. If the gunner knows the characteristic size and detail of men and equipment at known ranges, he can compare these characteristics to similar objects at unknown ranges. When characteristics match, so does the range.

(b) To use the appearance-of-objects method with any degree of accuracy, the gunner must know the characteristic details of objects as they appear at various ranges. For example, the gunner should study the appearance of a man standing at a range of 100 meters. He fixes the man's appearance firmly in his mind, carefully noting details of size and the characteristics of uniform and equipment. Next, he studies the same man in a kneeling position and then in a prone position. By comparing the appearance of the man at known ranges from 100 to 500 meters, the gunner can establish a series of mental images that will help determine range on unfamiliar terrain. Training should also be conducted in the appearance of other familiar objects such as weapons or vehicles. Because the successful use of this method depends upon visibility, anything that limits visibility (such as weather, smoke, or darkness) will also limit the effectiveness of this method.

(2) *100-Meter-Unit-of-Measure Method*. To use this method, the gunner visualizes a distance of 100-meters on the ground. For ranges up to 500-meters (Figure 5-26), he determines the number of 100-meter increments between the two points he wishes to measure. Beyond 500-meters (Figure 5-27), he selects a point halfway to the target, determines the number of 100-meter increments to the halfway point, and then doubles it to find the range to the target.

(a) During training, the gunner must become familiar with the effect that sloping terrain has on the appearance of a 100-meter increment. Terrain that slopes upward gives the illusion of longer distance, and observers have a tendency to overestimate the 100-meter increment. Terrain that slopes downward gives the illusion of shorter distance. In this case, the gunner's tendency is to underestimate the 100-meter increment and thus underestimate the range.

(b) Proficiency in the 100-meter-unit-of-measure method requires constant practice. When training in this technique, the gunner should make frequent comparisons between the range as determined by the himself and by pacing or other accurate means of measurement. The best training technique is to pace the range after he has visually determined it. In this way, he discovers the actual range for himself, which makes a much greater impression than if he is told the correct range.

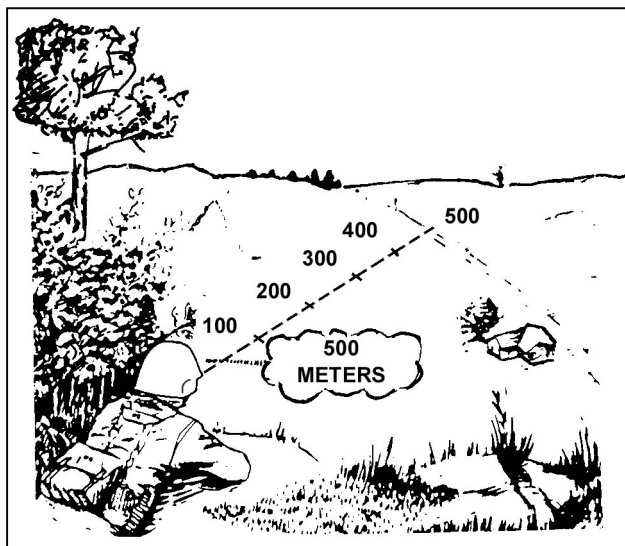


Figure 5-26. Applying the 100-meter-unit-of-measure method for ranges up to 500 meters.

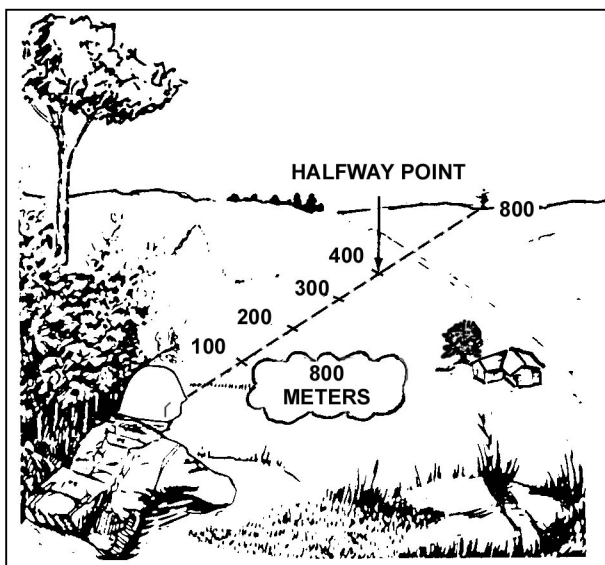


Figure 5-27. Applying the 100-meter-unit-of-measure method for ranges up to 800 meters.

(c) A limitation of the 100-meter-unit-of-measure method is that its accuracy is directly related to the amount of terrain visible to the gunner. This is particularly true at greater ranges. If a target appears at a range of 500 meters or more and the gunner can only see a portion of the ground between himself and the target, it becomes difficult to use the 100-meter-unit-of-measure method of range estimation with any degree of accuracy.

(3) *Combination of Methods.* Under ideal conditions, either the appearance-of-objects method or 100-meter-unit-of-measure method is an effective method of estimating range. However, ideal conditions rarely exist on the battlefield, so the gunner must use a combination of methods. The terrain might limit the use of the appearance-of-objects method. For example, a gunner may not be able to see all the terrain out to the target; however, he may see enough to get a general idea of the distance. A slight haze may obscure many of the target details, but the gunner should still be able to judge its size. By carefully considering the ranges estimated by both methods, an experienced gunner should arrive at a figure close to the true range. The best way to reduce errors using these two methods is to train often.

5-20. LATERAL DISTANCE MEASUREMENT

In addition to estimating range accurately, the gunner needs a quick method of measuring lateral distance (right or left) from a reference point to a target. When the machine gun is tripod-mounted, width can be measured by aiming on a point, manipulating the traversing handwheel, and counting the clicks from one point of aim to another point of aim. Each click equals 1 mil and is equivalent to 1 meter at 1,000 meters, or half a meter at 500 meters. When the machine gun is bipod-mounted, the gunner can use his fingers to measure the lateral distance between a reference point and a target. He extends his arm with his palm outward, lowers his fingers, and locks his elbow. Then, he closes one eye, raises his index finger, and sights along its edge, placing the edge of his finger so that it

appears to be along the flank of the target or reference point. The gunner fills the space remaining between the points by raising his fingers until the space is covered. He states the measurement from the reference point to the target as being one or more fingers, depending upon how many fingers are raised to cover this distance.

Section VII. ADVANCED GUNNERY

Once the gunner masters the four fundamentals of marksmanship in the prone position and fighting position, he needs practice in engaging targets that will most likely replicate the battlefield. The advanced gunnery field firing exercise for the gunner exposes him to different types of targets at various ranges to simulate combat conditions.

5-21. OBJECTIVES

The objectives of this training are to reinforce the fundamentals and increase the effectiveness of the gunner by building his confidence (*not for qualification*). He must acquire targets quickly and deliver an accurate volume of fire.

5-22. ORGANIZATION

The unit is assembled in the bleachers, given the training objectives, a range briefing, and a safety briefing. Gunners are then organized into firing orders with a gunner and an assistant gunner. (Concurrent training stations must be set up for those soldiers not on the firing line.)

5-23. AMMUNITION

This exercise requires 392 rounds of 7.62-mm linked ammunition (zero is included). The gunner is allotted two 7-round bursts for each target and fires twice.

5-24. FIRING SEQUENCE

The sequence of firing is to be conducted IAW Firing Table IV (Table 5-2). Commanders may score their soldiers to determine their most proficient gunners, to assess the marksmanship program, and to encourage competition.

a. **Task 1, Field Zeroing the 500-Meter, Single E-Type Silhouette.** The gunner is allocated 28 rounds of ammunition.

b. **Task 2, Engage Single E-Type Silhouettes From the Prone and Fighting Position, Bipod Supported (Point Targets) at Various Ranges.** The gunner will use his NBC equipment (Mask and Gloves). Targets are at 100, 200, 250, 300, and 400 meters. The gunner is allocated 70 rounds of ammunition.

c. **Task 3, Engage Double E-Type Silhouettes (Automatic Weapon Positions) at Various Ranges.** Targets are at 250, 300, 400, 500, and 600 meters. The gunner is allocated 70 rounds of ammunition.

d. **Task 4, Engage Linear E-Type Silhouettes (Troops on Line) at Various Ranges.** The gunner uses his NBC equipment (Mask and Gloves). Targets are at 300 and 600 meters. The gunner is allocated 28 rounds of ammunition.

WARNING

The M240B is carried loaded with the bolt locked to the *rear* in *tactical situations* where noise discipline is critical to the success of the mission. Trained gun crews are the only personnel authorized to load the M240B and only when command directs the crew to do so. During *normal training exercises*, the M240B is loaded and carried with the bolt in the *forward position*.

TASK	RANGE (M)	TIME	TOTAL ROUNDS PER INDIVIDUAL	TARGET	AMMO	TYPE FIRE
1	500	No limit	28	E-type silhouette	4:1	Zeroing 7-round bursts
2*	100 200 250 300 400	60 seconds	70	Single E-type silhouette	4:1	7-round bursts
3	250 300 400 500 600	120 seconds	70	Single E-type silhouette	4:1	7-round bursts
4*	300 600	120 seconds	28	Linear target Single E-type 1 meter apart	4:1	7-round bursts
* Indicates tasks fired with protective mask and gloves as a minimum.						

Table 5-2. Firing Table II.

5-25. ALTERNATE FIRING POSITIONS

All gunners must master the bipod-supported prone firing fighting position, and tripod-supported prone firing position to be effective. But it is also equally important that they know other positions. Each gunner must be trained to assume different positions quickly during various combat conditions. The situation determines the appropriate position. The gunner must establish his position so that he can effectively observe and engage the target yet minimize his exposure to enemy fire.

a. **Positions.** The underarm firing position and the hip firing position are used.

(1) *Underarm Firing Position.* This position is used almost exclusively when moving in and around the objective during the assault (Figure 5-28). To assume this position, the gunner—

(a) Puts the bipod legs and rear sight down for instant use in the prone position if necessary.

(b) Faces the target with his feet spread about shoulder width apart.

- (c) Places his left foot in front of the right with most of his weight on his left foot.
- (d) Bends both legs at the knees and leans forward at the waist.
- (e) With his right hand, firmly grasps the pistol grip, and with his right forearm holds the stock firmly against the side of his body at a point between his armpit and waist.
- (f) With his left hand, grasps the handguard firmly.
- (g) Points his left foot in the direction of the target while his right foot provides stability.
- (h) Depresses the muzzle of the machine gun slightly so the strike of rounds can be observed. (This reduces shooting high and takes advantage of ricochets.)
- (i) Leans toward the target before and during firing.



Figure 5-28. Underarm firing position.

(2) *Hip Firing Position.* This position is used when closing with the enemy, when a heavy volume of fire in the target area is required, and when rapid movement is not necessary (Figure 5-29). The only differences between this position and the underarm position are that the gunner—

- (a) Holds the rear of the stock firmly against the forward position of his right thigh.
- (b) Extends his arms fully downward.



Figure 5-29. Hip firing position.

b. **Alternate Firing Position Exercises.** The assault fire exercise challenges the gunner. It consists of point and area targets during a variety of conditions replicating the battlefield. These exercises, which involve fire and maneuver, must be carefully controlled for safety purposes.

(1) *Objectives.* This exercise gives the gunner practice on engaging targets as quickly as possible, using any of the alternate firing positions.

(2) *Organization.* The unit is assembled in the bleachers, given instructions, and briefed on training that will be conducted while they are on the range. After the briefing, they are organized into firing orders and moved to firing lanes. Lanes are conducted and used IAW local range policies.

(3) *Ammunition.* This exercise requires a total of 168 rounds of 7.62-mm linked ammunition. The gunner is allowed two bursts per exposure, and he is also required to conduct at least one rapid reload during the exercise and the gunner will fire this twice. The commander has the option of when the rapid reload may take place. Ammunition is configured into two belts of any size that requires the gunner to reload.

(4) *Firing Sequence.* The sequence of firing is conducted IAW Firing Table V (Table 5-3). The suggested sequence of firing is as follows.

(a) Task 1, Dry Fire Walk-Through. Upon his arrival at the firing position, the gunner walks through his respective lane to become familiar with the targets. No ammunition is fired at this time. When he returns, he draws his ammunition.

NOTE: Commanders ensure that ammunition is used in such a manner that the gunner is required to rapidly reload sometime during his movement phases.

(b) Task 2, Engage Single E-Type Silhouette from the Hip-Firing Position. After being issued the ammunition, the gunner begins his movement. When targets are exposed, he uses the hip-firing technique. He is given a single exposed target at a distance of 25 meters, with an exposure time of 5 seconds.

(c) Task 3, Engage Single E-Type Silhouettes from the Underarm-Firing Position. As the gunner continues to move through the course, he is given two single exposed E-type silhouettes at distances of 50 and 25 meters, where he engages each silhouette using the underarm-firing position. The exposure time for each target is 5 seconds.

(d) Task 4, Engage Single E-Type Silhouettes from the Underarm or Hip-Firing Position. Once the gunner reaches this point, he is be given three single exposed E-type silhouettes at distances of 25, 50, and 75 meters. The exposure time for each target is 5 seconds.

NOTE: The commander may integrate firing under NBC conditions for selected tasks while negotiating the course, or he may conduct the course during limited visibility unaided.

TASK	RANGE (M)	TIME	TOTAL ROUNDS PER INDIVIDUAL	TARGET	AMMO	TYPE FIRE
1	NA	No limit	NA	NA	NA	NA
2	25	5 seconds	14	Single E-type silhouette	4:1	7-round bursts
3	50	10 seconds	28	Single E-type silhouette	4:1	7-round bursts
4	25 50 75	15 seconds	42	Single E-type silhouette	4:1	7-round bursts

Table 5-3. Firing Table VIII.

5-26. MOVEMENT, SPEED, AND ALIGNMENT

The gunner must keep up with the other soldiers of the assaulting element through individual movement techniques. To do this, he moves as rapidly as possible, consistent with his ability to fire accurately and maintain alignment.

5-27. RELOADING

The gunner must reload rapidly to avoid lulls in the firing. This can be achieved by practicing and by applying the following techniques.

a. Before the assault, the gunner conducts prefire checks on the machine gun. He inspects ammunition to ensure that it is clean and serviceable, and he checks the box for serviceability.

b. During the assault, the gunner must continue moving forward and reload as rapidly as possible. The sling allows the gunner to reload using both hands.